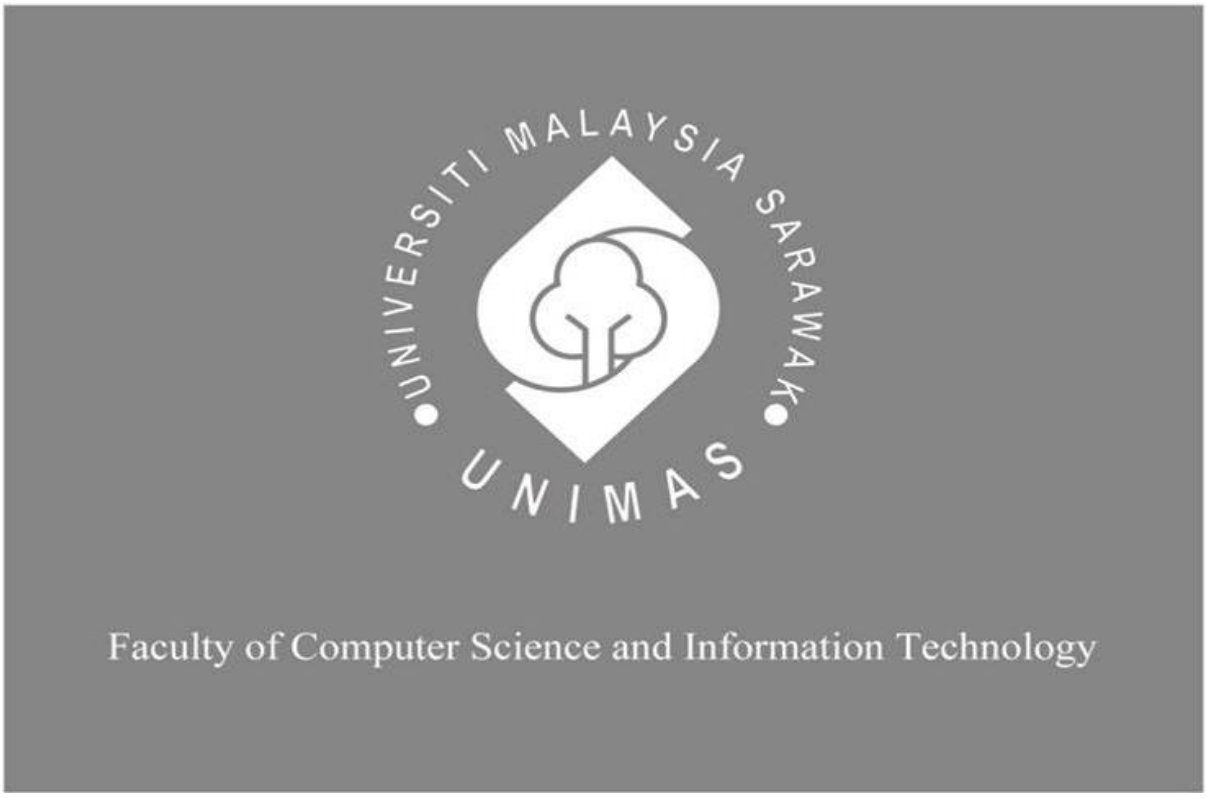

BiodivARsity: DEVELOPMENT OF AUGMENTED REALITY CARD GAME IN LEARNING BIODIVERSITY AMONG PRIMARY SCHOOL STUDENTS

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Bachelor of Computer Science with Honours

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This project is submitted in partial fulfilment of the requirements for the degree of Bachelor of Computer Science with Honours (Multimedia Computing)

Faculty of Computer Science and Information Technology

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BiodivARsity: PEMBANGUNAN PERMAINAN KAD BERASASKAN AUGMENTED REALITY DALAM MEMPELAJARI KEPELBAGAIAN BIO DI KALANGAN PELAJAR SEKOLAH RENDAH

NOOR AMIRAH SOFEA BINTI MOHD FAUDZI

Projek ini merupakan salah satu keperluan untuk Ijazah Sarjana Muda Sains Komputer dan Teknologi Maklumat dengan Kepujian (Pengkomputeran Multimedia)

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ABSTRACT

This project presents an educational card game application for primary school students to learn Science, within the topic of Biodiversity, using Augmented Reality (AR) technology. Research has shown that integrating AR in educational settings can enhance students' motivation and learning experience. The development of this project aims to improve students' comprehension and learning effectiveness in Science subject. Ten students from SK Jalan Muara Tuang, Kota Samarahan which consists of six females and four males were selected as the participants to study the efficacy of the project by responding to both pre-testing and post-testing usage evaluation materials. Analysis of the materials proved that incorporating AR technology into the learning environment increases the effectiveness by 6.4%. The pre-test result shows a mean score of 4.37 and a standard deviation of 0.386 while the post-test result shows a mean score of 4.69 and a standard deviation of 0.166. The evaluation results using ARCS (Attention, Relevance, Confidence, and Satisfaction) motivational model indicate that attention is the highest element that contributes to students' motivation of studying with a mean score and standard deviation of 4.83 and 0.386 respectively. BiodivARsity can be utilized as an augmented reality application that offers students the functions to learn through the superimposed learning content interactively and a function that enables students to test their knowledge by using the quiz section provided.

ABSTRAK

Projek ini memperkenalkan aplikasi pembelajaran menggunakan permainan kad yang berteraskan teknologi Augmented Realiti (AR) bertujuan membantu pelajar sekolah rendah mempelajari topik Kepelbagaian Bio yang terdapat di dalam subjek Sains. Penyelidikan telah menunjukkan bahawa mengintegrasikan AR dalam suasana pembelajaran dapat meningkatkan motivasi dan pengalaman pembelajaran pelajar. Pembangunan projek ini bertujuan untuk meningkatkan kefahaman pelajar dan keberkesanan pembelajaran dalam subjek Sains. Sepuluh pelajar dari SK Jalan Muara Tuang, Kota Samarahan yang terdiri dari enam pelajar perempuan dan empat pelajar lelaki telah dipilh sebagai peserta untuk mengkaji keberkesanan projek dengan memberi respons kepada bahan penilaian pra-ujian dan pasca-ujian. Analisis dari bahan penilaian membuktikan bahawa penggabungan teknologi AR dalam persekitaran pembelajaran dapat meningkatkan keberkesanan pembelajaran sebanyak 6.4%. Hasil pra-ujian menujukkan skor min sebanyak 4.37 dan sisihan piawai 0.386, manakala keputusan pasca-ujian menunjukkan skor min sebanyak 4.69 dan sisihan piawai sebanyak 0.166. Keputusan penilaian menggunakan model motivasi ARCS (Attention, Relevance, Confidence, dan Satisfaction) menunjukkan bahawa Attention merupakan elemen tertinggi yang menyumbang kepada motivasi pelajar untuk belajar, dengan skor min dan sisihan piawai masing-masing sebanyak 4.83 dan 0.386. BiodivARsity boleh digunakan sebagai aplikasi augmented realiti yang menawarkan fungsi pembelajaran melalui kandungan pembelajaran betumpu secara interaktif dan membolehkan pelajar menguji pengetahuan mereka dengan menggunakan bahagian kuiz yang disediakan.

CHAPTER 1 INTRODUCTION

1.1 Introduction

This chapter consists of ten sections. The first section explains the background of the study. The second section describes the problem statement, while the third section explains about the scopes of the project. The objectives of the project are identified in the fourth section. The fifth section of this chapter discusses the methodology that is going to be used in this project, while the sixth section explains the significance of the project. The seventh section consists of the schedule for this project. For the eighth section, a project outcome is identified while the ninth section explains about the project outline. A conclusion of the chapter is provided in the last section.

1.2 Background of Study

The use of AR has become increasingly ubiquitous in today's world, especially in the pedagogical learning environment. According to Chamba-Eras and Aguilar (2017), AR integrates physical and virtual objects to enhance the interaction between both worlds by passing the information to the physical world in real time. Unlike Virtual Reality, AR does not change the view of the world with an artificial view but overlays the interactive and digital content on the real-world environment. AR emphasizes how an individual perceives the world around them and incorporates it into the computer-aided real environment.

It is known that Science subject requires students' understanding on the learning materials. Most of the learning materials are purely text-based, besides having a passive method of learning. Moreover, it is important to provide a modern approach that utilizes the digital learning aspect. This makes a call for emerging technology such as AR that can be used to

complement the educational content in the Science syllabus in education. The use of AR in applications in educational environments encourages a way for an interactive learning environment and cause the students to obtain the cognitive and meta-cognitive skills for an enhanced transfer of learning (Weng, Bee, Yew, & Hsia, 2016).

Sirakaya and Sirakaya (2018) claimed that AR is used comprehensively in the education of secondary and primary school students. This is because students in this developmental level perceive through their sensory organs better when learning concrete concepts, and AR ensures concretization. Game-based learning offers substantial advantages to the learners by providing an interactive platform aimed to help learners to engage in the learning materials. Through playing games, students can actively improve their cognitive skills and this will contribute towards enhanced memorization and comprehension on the learning materials. However, this project will mainly focus on one subtopic, which is Biodiversity.

Biodiversity can be defined as the variability of life on Earth, including the life of animals, plants, and other living organisms in the ecosystem they form (Rawat & Agarwal, 2015). According to Bynum et al. (2008), the term biodiversity also refers to the interrelatedness of genes, species, and ecosystems and their interactions with the environment. Biodiversity is considered at three levels, which are genetic diversity, species diversity, and ecosystem diversity. Understanding the concept of biodiversity can take up some time as the concept is abstract. Besides, biodiversity is a broad topic to be covered and understood. Thus, in order to make the process of learning biodiversity to be more efficient and effective, a project is proposed to develop an interactive card game application for Standard 6 students by using AR technology.

1.3 Problem Statement

As Malaysia is entering Education 4.0 era, AR technology is aimed to be a new educational model that can facilitate the current pedagogical methods. However, there may not be enough AR applications that are developed specifically for educational purposes. Current learning materials are mostly based on a one-way flow of information, where students absorb information from a plain source such as texts, figures, and diagrams without getting any feedback. This causes students to face difficulties in trying to understand the educational content they are learning. Besides, the conventional learning approach and methods may cause students to lose interest and motivation in learning. According to Izwan Nurli Mat Bistaman et al. (2018), the level of maturity among students varies from those who can understand easily to those who are difficult to understand. Practicing the traditional learning method means students can only do so much to understand what they are learning.

1.4 Scopes of Project

In this project, the Science topic that is going to be covered in the AR card game application falls under the Biodiversity subtopic. The application will exclusively be developed for students who are currently in their primary education in Standard 6. To follow the Standard Based Curriculum for Primary Schools (KSSR), this project will be developed in Malay language, based on the learning units covered in Standard 6 Science syllabus in Malaysia, which are Unit 4: Interaction Between Life *(Interaksi Antara Hidupan)* and Unit 5: Conservation and Preservation (*Pemuliharaan dan Pemeliharaan)*. Lastly, the application can only be played with its own cards, meaning that other learning materials such as figures and images that do not exist in the cards will not work on the application.

1.5 Objectives

The main purpose of this project is to develop a modern platform that utilizes emerging AR technology as an additional pedagogical tool in educational settings. Meanwhile, the specific objectives for this project are as follows:

- To propose a method for improving students' comprehension and learning experience in the Science subject.
- To develop an interactive AR card game application for Standard 6 students to learn Biodiversity.
- To test the usability and the effectiveness of the application among students to understand Biodiversity topic in Science.

1.6 Brief Methodology

The methodology that is going to be used in this project is Rapid Application Development (RAD) methodology. RAD practices rapid prototyping and application development that contributes towards ensuring high quality and faster deliverables. It also promotes an iterative process of development. Figure 1.1 shows the phases in RAD methodology.

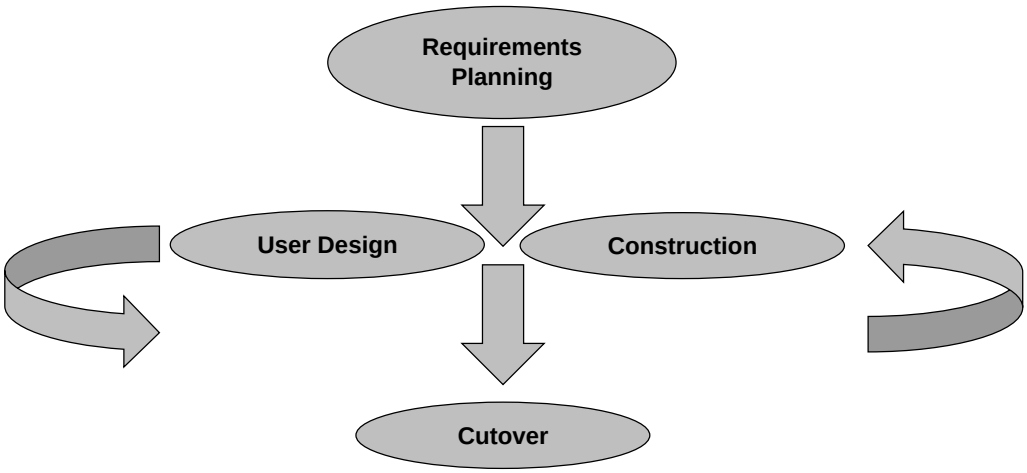

Figure 1.1. RAD Methodology Phases

There are four phases involved in RAD methodology, which is Requirements Planning, User Design, Construction, and Cutover. Note that User Design and Construction phases can be iterative and do not have to be executed sequentially, unlike traditional methodology. While providing incremental and iterative development, RAD also increase the flexibility of a project as it allows and adapts with frequent changes. A brief description of each stage in RAD methodology that is going to be implemented in this project is as below:

1.6.1 Requirements Planning

This phase requires a comprehensive and thorough plan and requirement analysis to identify the problems, project objectives, project scopes, collect information and requirements of the project, such as the targeted users, and determine the project outcome. The requirements collected must be quantitative, measurable and relevant.

1.6.2 User Design

This phase focuses on the development of user design by using the different prototype in iterations. This phase requires target users and developers to work together to achieve the goals in the design process. Changes and bugs are identified in this phase to ensure smoothness of project construction.

1.6.3 Construction

Construction phase converts the plan into a working product. This phase occurs rapidly, and the features are going to be built, tested to the testers, which are the targeted users until the product meets the objectives and user requirements.